

Decelerating and Dustfree: Efficient Dark Energy Studies with Supernovae and Clusters

Principal Investigator: Dr. Saul Perlmutter

Institution: Lawrence Berkeley National Laboratory

Electronic Mail: saul@lbl.gov

Scientific Category: COSMOLOGY

Scientific Keywords: COSMOLOGICAL PARAMETERS AND DISTANCE SCALE, CLUSTERS OF GALAXIES, SUPERNOVAE, GRAVITATIONAL LENSING

Instruments: ACS, NICMOS

Proprietary Period: 12

Orbit Request	Prime	Parallel
Cycle 16	188	28

Abstract

Our cycle 14 program has proved a new, extremely efficient approach to obtain $z > 1$ dust-free Type Ia supernovae, and we propose to capitalize on this new technique. We will collect a total sample of ~ 20 $z > 1$ SNe Ia in cluster elliptical galaxies, each of which will carry the weight of up to 9 color-corrected $z > 1$ SNe hosted by spiral galaxies. The measurement will yield dark energy constraints that do not suffer from the major systematic and statistical uncertainty at these redshifts, that of extinction correction. By targeting massive galaxy clusters at $z > 1$, we probe a well-understood host galaxy environment, and obtain more than five-times higher efficiency than a survey of random fields in detection of Ia supernovae in elliptical galaxies. The data will make possible a factor of two improvement on supernova constraints on dark energy time evolution dynamics, and a much larger improvement on systematic uncertainty, taking advantage of the uniquely well-controlled host environment that clusters provide. These same deep cluster images also yield fundamental mass calibrations required for ongoing and future studies which aim to measure dark energy via the evolution of cluster abundances, as well as an entire program of cluster studies. We will obtain both a cluster dataset and a SN Ia dataset that will be a longstanding scientific resource.

Decelerating and Dustfree: Efficient Dark Energy Studies with Supernovae and Clusters

Investigators:

	Investigator	Institution	Country
PI	Dr. Saul Perlmutter	Lawrence Berkeley National Laboratory	USA/CA
CoI	Dr. Greg Aldering	Lawrence Berkeley National Laboratory	USA/CA
CoI	Mr. Rahman Amanullah	University of California - Berkeley	USA/CA
CoI	Mr. Kyle Barbary	University of California - Berkeley	USA/CA
CoI	Prof. L Felipe Barrientos	Universidad Catolica de Chile	Chile
CoI	Dr. Mark Brodwin	Jet Propulsion Laboratory	USA/CA
CoI	Dr. Kyle Dawson	Lawrence Berkeley National Laboratory	USA/CA
CoI	Dr. Arjun Dey	National Optical Astronomy Observatories, AURA	USA/AZ
CoI	Dr. Mamoru Doi	University of Tokyo, Institute of Astronomy	Japan
CoI	Dr. Megan Donahue	Michigan State University	USA/MI
CoI	Dr. Peter Eisenhardt	Jet Propulsion Laboratory	USA/CA
CoI	Dr. Erica Ellingson	University of Colorado at Boulder	USA/CO
CoI	Dr. Andrew S. Fruchter	Space Telescope Science Institute	USA/MD
CoI	Dr. David Gilbank	University of Toronto	Canada
CoI	Dr. Michael D. Gladders	University of Chicago	USA/IL
CoI	Dr. Gerson Goldhaber	Lawrence Berkeley National Laboratory	USA/CA
CoI	Dr. Anthony H. Gonzalez	University of Florida	USA/FL
CoI	Dr. Buell T. Jannuzi	National Optical Astronomy Observatories, AURA	USA/AZ
CoI*	Dr. Ariel Goobar	Stockholm University	Sweden
CoI	Dr. Joseph Hennawi	University of California - Berkeley	USA/CA
CoI	Dr. Henk Hoekstra	University of Victoria	Canada
CoI	Dr. David Johnston	Jet Propulsion Laboratory	USA/CA
CoI	Dr. Nobunari Kashikawa	National Astronomical Observatory of Japan (NAOJ)	Japan
CoI	Dr. Benjamin Koester	University of Chicago	USA/IL
CoI	Dr. Natalia Kuznetsova	Lawrence Berkeley National Laboratory	USA/CA
CoI*	Dr. Christopher Lidman	European Southern Observatory - Chile	Chile
CoI	Dr. Eric Linder	Lawrence Berkeley National Laboratory	USA/CA
CoI	Prof. Lori M. Lubin	University of California - Davis	USA/CA
CoI	Mr. Tomoki Morokuma	University of Tokyo, Institute of Astronomy	Japan
CoI	Dr. Christopher Mullis	University of Michigan	USA/MI
CoI	Dr. Nino Panagia	Space Telescope Science Institute	USA/MD

Decelerating and Dustfree: Efficient Dark Energy Studies with Supernovae and Clusters

	Investigator	Institution	Country
CoI	Dr. Marc Postman	Space Telescope Science Institute	USA/MD
CoI	Dr. Jason Rhodes	Jet Propulsion Laboratory	USA/CA
CoI*	Dr. Piero Rosati	European Southern Observatory - Germany	Germany
CoI	Mr. David Rubin	University of California - Berkeley	USA/CA
CoI	Dr. David J. Schlegel	Lawrence Berkeley National Laboratory	USA/CA
CoI	Dr. Anthony L. Spadafora	Lawrence Berkeley National Laboratory	USA/CA
CoI	Dr. S. Adam Stanford	University of California - Davis	USA/CA
CoI*	Dr. Vallery Stanishev	Stockholm University	Sweden
CoI	Dr. Daniel Stern	Jet Propulsion Laboratory	USA/CA
CoI	Dr. Nao Suzuki	Lawrence Berkeley National Laboratory	USA/CA
CoI	Dr. Lifan Wang	Texas A & M Research Foundation	USA/TX
CoI	Dr. Naoki Yasuda	University of Tokyo, Institute of Cosmic Ray Research	Japan
CoI	Dr. Howard K. Yee	University of Toronto	Canada

Number of investigators: 44

* ESA investigators: 4

Target Summary:

Target	RA	Dec	Magnitude
ISCS1432.+3250	14 32 24.1600	+32 50 3.70	V = 25.0
1012.28	14 34 28.5200	+34 26 22.90	V = 25.0
1012.52	14 32 29.1800	+33 32 48.30	V = 25.0
1113.7.7	14 29 18.5100	+34 37 25.80	V = 25.0
ISCS1432.3+3253	14 32 18.3100	+32 53 7.80	V = 25.0
1315.5.16	14 38 9.5400	+34 14 19.20	V = 25.0
ISCS1426.5+3339	14 26 30.4200	+33 39 33.20	V = 25.0
ISCS1433.1+3340	14 33 10.9900	+33 40 34.60	V = 25.0
IRAC0223-04	02 23 3.7000	-04 36 18.00	V = 25.0
RCS0220-03	02 20 55.7000	-03 33 19.00	V = 25.0
RCS0221-03	02 21 41.9500	-03 21 47.40	V = 25.0
RCS0337-28	03 37 50.4000	-28 44 28.70	V = 25.0
RCS0439-29	04 39 38.0400	-29 04 55.20	V = 25.0
RCS1511+09	15 11 3.8000	+09 03 15.00	V = 25.0

Decelerating and Dustfree: Efficient Dark Energy Studies with Supernovae and Clusters

Target	RA	Dec	Magnitude
RCS2156-04	21 56 42.1500	-04 48 4.10	V = 25.0
RCS2319+00	23 19 53.3800	+00 38 13.90	V = 25.0
RCS2345-36	23 45 27.3000	-36 32 50.00	V = 25.0
RDCS0848+44	08 48 58.6400	+44 51 57.00	V = 25.0
RDCS1252-29	12 52 54.2800	-29 27 17.90	V = 25.0
XMM2215-15	21 15 58.5000	-17 38 2.00	V = 25.0
XMMUJ2235	22 35 20.8300	-25 57 39.90	V = 25.0
XMMUJ1229+01	12 29 28.8000	+01 51 34.00	V = 25.0
CL1604+43	16 04 22.6000	+43 04 39.70	V = 25.0
RDCS0910+54	09 10 45.0700	+54 22 10.10	V = 25.0
TOO-SN-11ORB	14 16 30.0000	+32 30 0.00	V = 25.0
TOO-SN-2ORB	08 48 0.0000	+44 00 0.00	V = 25.0
TOO-SN-1ORB	12 52 0.0000	-29 00 0.00	V = 25.0

Observing Summary:

Target	Config Mode and Spectral Elements	Flags	Orbits
ISCS1432.+3250	ACS/WFC Imaging F850LP		8 (1x8)
1012.28	ACS/WFC Imaging F850LP		9 (1x9)
1012.52	ACS/WFC Imaging F850LP		9 (1x9)
1113.7.7	ACS/WFC Imaging F850LP		9 (1x9)
ISCS1432.3+3253	ACS/WFC Imaging F850LP		9 (1x9)
1315.5.16	ACS/WFC Imaging F850LP		9 (1x9)
ISCS1426.5+3339	ACS/WFC Imaging F850LP		9 (1x9)
ISCS1433.1+3340	ACS/WFC Imaging F850LP		9 (1x9)
IRAC0223-04	ACS/WFC Imaging F850LP		8 (1x8)
RCS0220-03	ACS/WFC Imaging F850LP		8 (1x8)
RCS0221-03	ACS/WFC Imaging F850LP		8 (1x8)
RCS0337-28	ACS/WFC Imaging F850LP		8 (1x8)
RCS0439-29	ACS/WFC Imaging F850LP		7 (1x7)
RCS1511+09	ACS/WFC Imaging F850LP		7 (1x7)
RCS2156-04	ACS/WFC Imaging F850LP		7 (1x7)
RCS2319+00	ACS/WFC Imaging F850LP		7 (1x7)

Decelerating and Dustfree: Efficient Dark Energy Studies with Supernovae and Clusters

Target	Config Mode and Spectral Elements	Flags	Orbits
RCS2345-36	ACS/WFC Imaging F850LP		7 (1x7)
RDCS0848+44	ACS/WFC Imaging F850LP		7 (1x7)
RDCS1252-29	ACS/WFC Imaging F850LP		7 (1x7)
XMM2215-15	ACS/WFC Imaging F850LP		7 (1x7)
XMMUJ2235	ACS/WFC Imaging F850LP		7 (1x7)
XMMUJ1229+01	ACS/WFC Imaging F850LP		7 (1x7)
CL1604+43	ACS/WFC Imaging F850LP		8 (1x8)
RDCS0910+54	ACS/WFC Imaging F850LP		7 (1x7)
TOO-SN-11ORB	NIC2 Imaging F110W	CPAR, TOO	14 (7x2)
TOO-SN-2ORB	NIC2 Imaging F110W	CPAR, TOO	4 (2x2)
TOO-SN-1ORB	NIC2 Imaging F110W	CPAR, TOO	10 (1x10)

Total prime orbits: 188

Total coordinated parallel orbits: 28